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Canadian Science Advisory Secretariat
Science Response 2015/026

Quebec Region

UPDATE OF STOCK STATUS INDICATORS FOR QUEBEC NORTH SHORE (DIVISION 4S) HERRING IN 2014

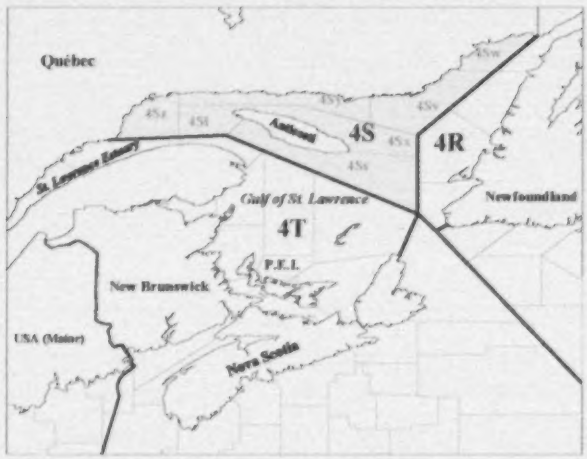

Figure 1. NAFO Division 4S unit areas (Quebec North Shore).

Context

The stock assessment for herring (*Clupea harengus*), fall and spring spawners from Division 4S (Figure 1) is carried out every 4 years and the last assessment occurred in February 2011. A regular assessment was planned for 2015, but had to be postponed. In order to provide information for managing these stocks it has been suggested that an update of the main indicators of this resource be done to determine if major changes in stock status have occurred.

This Science Response results from the Science Response Process of April 30, 2015, on the Stock Status Update of Herring in 4S.

Analysis and Response

Landings

Between 1979 and 2010, the average reported annual herring landings in Division 4S were 590 t, ranging from a maximum of 2,885 t in 1983 to a minimum of 120 t in 2007. Actual catches may have been higher since bait fishing is not closely monitored, so that these catches are unknown. Catches have increased significantly since 2010, reaching or exceeding the preventive TAC of 4,000 t (Figure 2). They were 2,810 t, 4,385 t, 4,049 t and 3,284 t respectively from 2011 to 2014. The data for 2014 are still preliminary and the preventive TAC may be reached since an early fishery closing notice was issued in August because it was likely that catches would reach the TAC.

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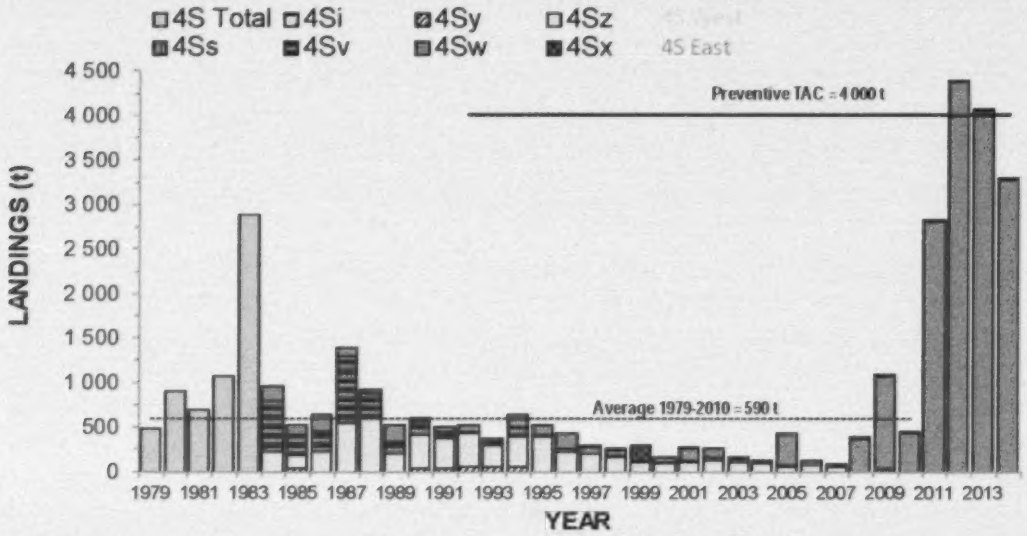

Figure 2. Preventive TAC and reported catches of herring for NAFO Division 4S per unit area, in groups designated western 4S (4Si, 4Sy, 4Sz) and eastern 4S (4Ss, 4Sv, 4Sw, 4Sx). Data on landings per unit area are not available before 1984.

Beginning in 1984, most herring catches in NAFO Division 4S occurred in three unit areas, namely 4Sz (western 4S sector), 4Sv and 4Sw (eastern 4S sector (Figure 2)). On average, between 1984 and 2007, 56% of landings were in the western sector, mainly from unit area 4Sz. Since 2008, more than 98% of catches have occurred in the eastern sector, and almost exclusively in unit area 4Sw. Recent catches in unit area 4Sv have been low (10 t or less between 2010 and 2014).

Historically, gillnets have been the main gear used for fishing herring in eastern and western Division 4S (85% of reported catches between 1984 and 2007). Traps replaced gillnets (eastern sector only) and between 2008 and 2010 represented 73% of annual catches. Beginning in 2011, the purse seine has been used most often, making up 74% of catches, while traps made up 24% of catches and gillnets only 2% of catches.

Stock status indicators

The age structures of both herring spawning groups sampled in the Quebec North Shore region are characterized by the periodic presence of a dominant year-class. Among spring spawners in unit area 4Sz, these year-classes occurred in 1975, 1980, 1982, 1990, 1994 and 2002 (Figure 3A). The dominant classes were less numerous among the fall spawners in unit areas 4Sv and 4Sw and correspond to the years 1979, 1995 and 2000 (Figure 3B). There has not been a dominant year-class since 2000 among fall spawners and since 2002 among spring spawners. The age frequencies appear to be disproportionate in 2013 and 2014 among spring spawners, but are based on small sample sizes (n=36 in 2013 and n=11 in 2014).

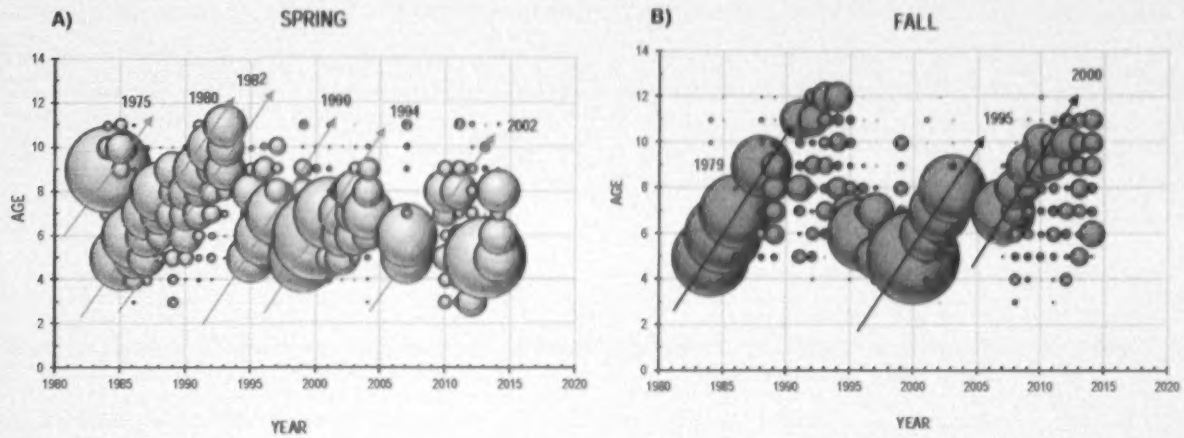

Figure 3. Annual age frequencies (%) for spring herring (4Sz) (A) and fall herring (4Sv, 4Sw) (B) from commercial fishery samples in NAFO Division 4S, from 1984 to 2014. The dominant year-classes are shown.

The average length and mass at age for both herring spawning groups in the Quebec North Shore region has gradually decreased over the years. During the period in which catches were low and the fishery was dominated by gillnets (1983 to 2007), the average mass at age 5 of both spawning groups decreased gradually from 41% for spring spawners and 39% for fall spawners (Figure 4). Since 1997, the average length at age 5 has remained less than 300 mm and the somatic mass less than 200 g (Figure 4). This trend has also been observed in the other age groups. However, a slight trend towards higher values has been observed since 2011. The limited number of fish measured for spring spawning herring and the recent changes in fishing pattern (seasonality and selectivity of fishing gear) could have an impact on these biological data.

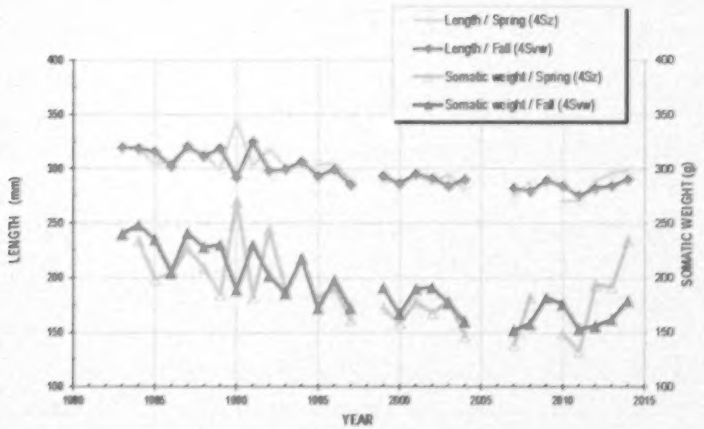

Figure 4. Average length (mm) and somatic mass (g) at age 5 for spring herring (4Sz) and fall herring (4Sv, 4Sw) from commercial fishery samples in NAFO Division 4S, from 1983 to 2014.

Multidisciplinary bottom trawl survey

Although herring is regularly caught, DFO's multidisciplinary bottom trawl surveys do not lend themselves to catches and abundance measurements for pelagic fish such as herring. For these

reasons, only presence/absence data are used with a geostatistic method (indicator kriging) to determine the surfaces associated with various probabilities of finding herring (Figure 5). Compared to 2010, the probability of finding herring during the surveys carried out in 2011 to 2014 increased in the Sept-Îles region (4Sz). This probability also increased in 2012 and 2013 in northern Anticosti, then decreased in 2014.

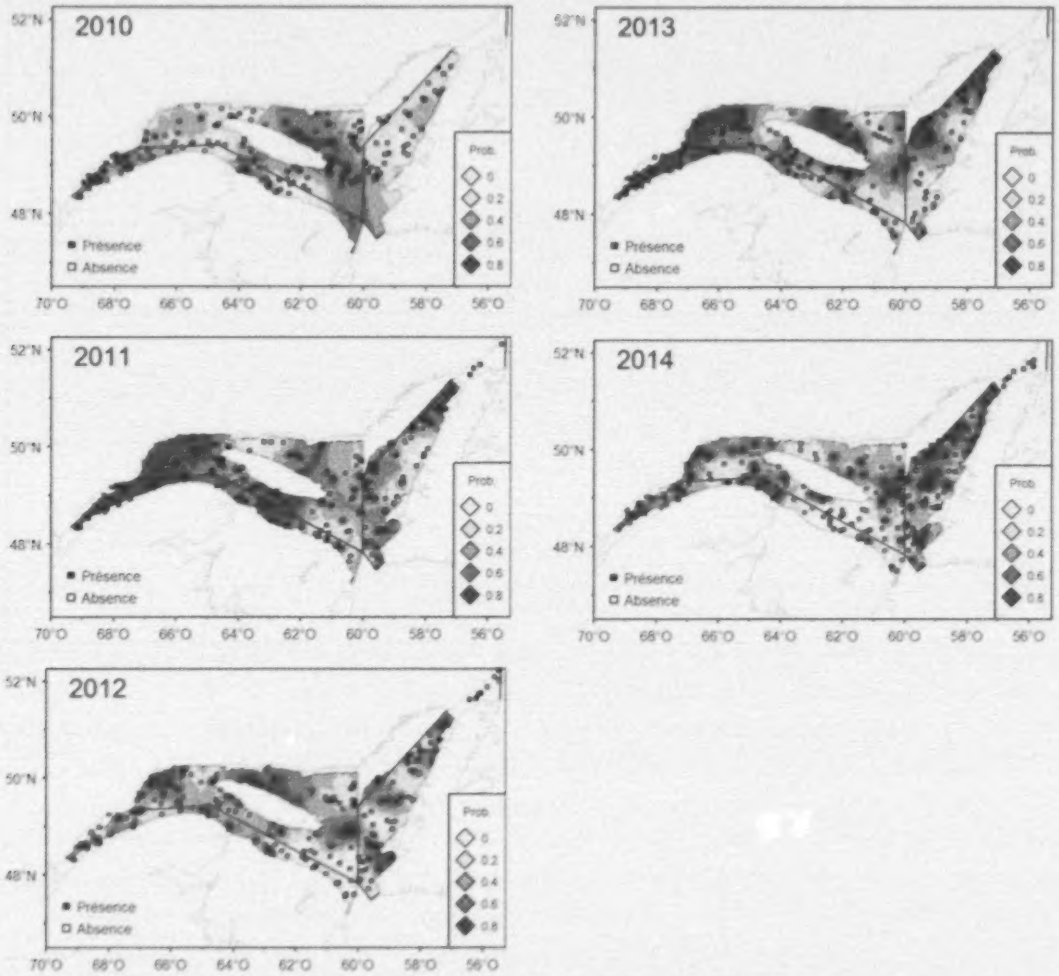

Figure 5. Herring presence probability surface contours (%) for the August multidisciplinary bottom trawl surveys of CCGS Teleost. The data from NAFO Divisions 4R, 4S and 4T are represented.

The probabilities of finding herring were used to calculate a dispersion index. This index shows a significant rise throughout the period from 1990 to 2000-2001, from 25% to almost 80%, the minimum and maximum values in the 1990-2014 series. This increase was followed by a decrease to 45% in 2003, slightly below the lower reference limit (Figure 6). Afterwards, the index rose in 2004 and remained stable, near the upper reference limit, until 2009, after which it plunged again to the lower reference limit in 2010 to a value comparable to that of 2003. From 2011 to 2013, the index rose and has remained between the reference limits, and in 2014 finally fell below the lower reference limit of the average for the 1990-2013 period. This index does not cover all of Division 4S. The bottom trawl survey does not cover unit area 4Sw, and only partially covers unit area 4Sv because of its bottom topography.

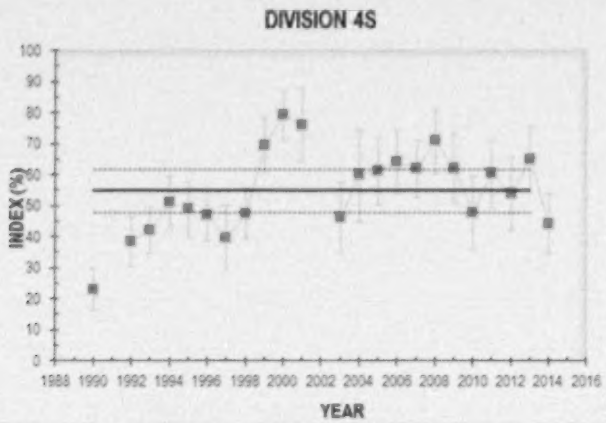

Figure 6. Dispersion index based on the average probabilities of finding herring in NAFO Division 4S during multidisciplinary bottom trawl surveys. The error bars indicate the 95% confidence interval. The solid horizontal lines indicate the series average for 1990-2013, and the upper and lower dashed lines indicate the reference limits.

Conclusions

The fishing pattern of these stocks has changed considerably since the last assessment. Catches have increased significantly from 2011 and reached or exceeded the preventive TAC of 4000 t in 2012 and 2013. This situation had never occurred since the TAC was established in 1992.

From 2011 to 2014, almost 100% of landings occurred in the eastern 4S sector (4Sw) using purse seine gear (74%) or traps (24%). The purse seine was little used before 2011.

The preventive TAC of 4000 t is available for all of Division 4S and for both herring stocks, the spring and fall spawners. Since 2011, almost all herring landings have been made up of fall spawners from a single unit area (4Sw) that are caught by a very limited number of users.

Although the herring fishery is dominated mainly by fall spawners, there has been no dominant year-class in this group since 2000, and the last significant year-class for spring spawners occurred in 2002.

The length and average mass at age 5 have decreased significantly in both spawning groups in the period 1983 to 2007, during which the fishery was dominated by gillnets and total landings were generally less than 1000 t.

From 2011 to 2013, the dispersion index rose and has remained between the reference limits, and in 2014 finally fell below the lower reference limit of the average for the 1990-2013 period.

The decrease in length and mass at age seen since 1983, as well as the absence of dominant year-classes since 2000 (fall spawners) and 2002 (spring spawners) combined with low fishing mortality is indicative of a drop in productivity of these stocks in the last few decades. Similar patterns possibly related to variations in environmental conditions have been observed in 4R herring stocks.

Given the significant increase in catches in the past few years, the change in fishing pattern and the absence of reliable biomass indicators, closer monitoring of catches and biological characteristics is warranted.

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Sources of Information

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